

WHAT IS CLAIMED IS:

1. A data transmission method for placing variable-length transmission data in each frame having a fixed time  
5 length to transmit the frame, comprising the steps of:

at a transmitting side,

calculating an error-detecting code of the transmission data in the frame only if the frame contains the transmission data;

10 generating frame data containing the transmission data and the calculated error-detecting code of the transmission data if the frame contains the transmission data, and generating frame data that contains neither the transmission data nor the error-detecting code  
15 of the transmission data if the frame does not contain the transmission data; and

transmitting the generated frame data; and

at a receiving side,

receiving the frame data;

20 determining the transmission data and the error-detecting code of the transmission data by determining a predetermined position in the received frame data as the final bit position of the frame data, and calculating an error-detecting code based on the  
25 determined transmission data;

deciding that the frame contains the transmission data if the determined error-detecting code

matches the error-detecting code calculated based on the determined transmission data, and deciding that the frame data does not contain the transmission data or the received frame data contains an error if the determined error-

5 detecting code does not match the calculated error-detecting code; and

obtaining the transmission data in the frame based on the result of the decision.

10 2. A data transmission method for placing variable-length transmission data in each frame having a fixed time length to transmit the frame, comprising the steps of:

at a transmitting side,

calculating an error-detecting code of the  
15 transmission data in the frame only if the frame contains the transmission data;

generating frame data containing the  
transmission data and the calculated error-detecting code  
of the transmission data if the frame contains the  
20 transmission data, and generating frame data that contains  
neither the transmission data nor the error-detecting code  
of the transmission data if the frame does not contain the  
transmission data; and

transmitting the generated frame data; and  
25 at a receiving side,

receiving the frame data;

assuming the transmission data and the error-

detecting code of the transmission data by assuming one or more final bit positions of the received frame data, and calculating an error-detecting code based on the assumed transmission data;

5           deciding a position to be the final bit position of the frame data if there is the position in the frame where the assumed error-detecting code matches the error-detecting code calculated based on the assumed transmission data among the assumed final bit positions  
10 of the frame data, and deciding that the frame does not contain the transmission data or the received frame data contains an error if there is no position where the assumed error-detecting code matches the calculated error-detecting code; and

15           obtaining the transmission data in the frame based on the result of the decision.

3. The data transmission method as claimed in claim 1 or 2, wherein, at the transmitting side, the step of  
20 generating the frame data generates the frame data in which the error-detecting code is placed after the corresponding transmission data and the bits of the error-detecting code are arranged in the order that is the reverse of the order of the bits of the transmission data.

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4. The data transmission method as claimed in claim 1 or 2, further comprising the steps of:

at the transmitting side,  
conducting error-correcting coding of the  
generated frame data; and  
conducting interleaving of the frame data that  
5 has undergone the error-correcting coding; and  
at the receiving side,  
conducting deinterleaving of the received frame  
data; and  
conducting error-correcting decoding of the  
10 frame data that has undergone the deinterleaving.

5. The data transmission method as claimed in claim 1  
or 2, wherein, at the transmitting side, the data  
transmission method further comprises the step of  
15 calculating transmission rate information indicating the  
number of bits of the transmission data in each frame, and  
the step of generating the frame data generates the frame  
data containing the calculated transmission rate  
information.

20  
6. The data transmission method as claimed in claim 1  
or 2, wherein, if the frame contains the transmission data,  
the length of the transmission data is within the range  
from 1 to X bits, the length of the error-detecting code  
25 associated with the transmission data is Y bits, and the  
combination of X and Y is one of (X,Y)=(8,8), (244,12),  
(4080,16) , and (1048576,24).

7. The data transmission method as claimed in claim 1,  
wherein

the data transmission method multiplexes  
5 variable-length transmission data for channels in a first  
channel group of one or more channels and transmission data  
for channels in a second channel group of one or more  
channels into each frame having a fixed time length to  
transmit the frame, and

10 at the transmitting side,

the step of calculating the error-detecting code  
calculates the error-detecting code of the transmission  
data for each channel in the first channel group only if  
the frame contains the transmission data for the channel;

15 the step of generating the frame data generates,  
for each channel in the first channel group, partial frame  
data containing the transmission data for the channel and  
the calculated error-detecting code of the transmission  
data for the channel if the frame contains the transmission  
20 data for the channel, and generates, for each channel in  
the first channel group, partial frame data containing  
neither the transmission data for the channel nor the  
error-detecting code of the transmission data for the  
channel if the frame does not contains the transmission  
25 data for the channel; and

the step of transmitting the frame data transmits  
the whole frame data containing the generated partial frame

data for each channel in the first channel group, and  
at the receiving side,

the step of receiving the frame data receives the  
whole frame data;

5 the step of calculating the error-detecting code  
determines the transmission data for each channel in the  
first channel group and the error-detecting code of the  
transmission data for the channel by determining a  
predetermined position in the partial frame data for the  
10 channel contained in the received whole frame data as the  
final bit position and calculates an error-detecting code  
based on the decided transmission data for the channel;

the step of deciding decides, for each channel  
in the first channel group, that the partial frame data  
15 for the channel contains the transmission data for the  
channel if the determined error-detecting code of the  
determined transmission data for the channel matches the  
error-detecting code calculated based on the determined  
transmission data for the channel, and decides, for each  
20 channel in the first channel group, that the frame does  
not contain the transmission data for the channel or the  
partial frame data for the channel contains an error if  
the determined error-detecting code of the determined  
transmission data for the channel does not match the  
25 error-detecting code calculated based on the determined  
transmission data for the channel; and

the step of obtaining the transmission data

obtains the transmission data for each channel in the first channel group in the frame based on the result of the decision.

5 8. The data transmission method as claimed in claim 2, wherein

the data transmission method multiplexes variable-length transmission data for channels in a first channel group of one or more channels and transmission data  
10 for channels in a second channel group of one or more channels into each frame having a fixed time length to transmit the frame, and

at the transmitting side,

the step of calculating the error-detecting code  
15 calculates the error-detecting code of the transmission data for each channel in the first channel group only if the frame contains the transmission data for the channel;

the step of generating the frame data generates, for each channel in the first channel group, partial frame  
20 data containing the transmission data for the channel and the calculated error-detecting code of the transmission data for the channel if the frame contains the transmission data for the channel, and generates, for each channel in the first channel group, partial frame data containing  
25 neither the transmission data for the channel nor the error-detecting code of the transmission data for the channel if the frame does not contains the transmission

data for the channel; and

the step of transmitting the frame data transmits the whole frame data containing the generated partial frame data for each channel in the first channel group, and

5 at the receiving side,

the step of receiving the frame data receives the whole frame data;

the step of calculating the error-detecting code assumes the transmission data for each channel in the first  
10 channel group and the error-detecting code of the transmission data for the channel by assuming one or more final bit positions of the partial frame data for the channel contained in the received whole frame data and calculates an error-detecting code based on the assumed  
15 transmission data for the channel;

the step of deciding decides, for each channel in the first channel group, a position to be the final bit position of the partial frame data for the channel if there is the position where the assumed error-detecting code of  
20 the transmission data for the channel matches the error-detecting code calculated based on the assumed transmission data for the channel among the assumed final bit positions of the partial frame data for the channel, and decides, for each channel in the first channel group,  
25 that the frame does not contain the transmission data for the channel or the partial frame data for the channel contains an error if there is no position where the assumed



error-detecting code of the transmission data for the channel matches the error-detecting code calculated based on the assumed transmission data for the channel among the assumed final bit positions of the partial frame data for the channel; and

the step of obtaining the transmission data obtains the transmission data for each channel in the first channel group in the frame based on the result of the decision.

9. The data transmission method as claimed in claim 7 or 8, wherein dual closed loop transmission power control comprising inner loop transmission power control and outer loop transmission power control is performed for the data transmission between the transmitting side and the receiving side and one or more channels in the second channel group are used as the reference for the outer loop transmission power control without using channels in the first channel group as the reference.

10. The data transmission method as claimed in claim 9, wherein the relative ratio between error-correcting coding ratios of the multiplexed channels and the relative ratio between transmission powers for the multiplexed channels are fixed.

11. A data transmission system for placing variable-

length transmission data in each frame having a fixed time length to transmit the frame, comprising:

in a transmitter,

means for calculating an error-detecting code of the transmission data in the frame only if the frame contains the transmission data;

means for generating frame data containing the transmission data and the calculated error-detecting code of the transmission data if the frame contains the transmission data, and generating frame data that contains neither the transmission data nor the error-detecting code of the transmission data if the frame does not contain the transmission data; and

means for transmitting the generated frame data;

and

in a receiver,

means for receiving the frame data;

means for determining the transmission data and the error-detecting code of the transmission data by determining a predetermined position in the received frame data as the final bit position of the frame data, and calculating an error-detecting code based on the determined transmission data;

means for deciding that the frame contains the transmission data if the determined error-detecting code matches the error-detecting code calculated based on the determined transmission data, and deciding that the frame

data does not contain the transmission data or the received data contains an error if the determined error-detecting code does not match the calculated error-detecting code; and

5                   means for obtaining the transmission data in the frame based on the result of the decision.

12. A data transmission system for placing variable-length transmission data in each frame having a fixed time length to transmit the frame, comprising:

10                   in a transmitter,

                  means for calculating an error-detecting code of the transmission data in the frame only if the frame contains the transmission data;

15                   means for generating frame data containing the transmission data and the calculated error-detecting code of the transmission data if the frame contains the transmission data, and generating frame data that contains neither the transmission data nor the error-detecting code of the transmission data if the frame does not contain the transmission data; and

                  means for transmitting the generated frame data;

and

                  in a receiver,

25                   means for receiving the frame data;

                  means for assuming the transmission data and the error-detecting code of the transmission data by assuming

one or more final bit positions of the received frame data,  
and calculating an error-detecting code based on the  
assumed transmission data;

means for deciding a position to be the final bit  
5 position of the frame data if there is the position in the  
frame where the assumed error-detecting code matches the  
error-detecting code calculated based on the assumed  
transmission data among the assumed final bit positions  
of the frame data, and deciding that the frame does not  
10 contain the transmission data or the received frame data  
contains an error if there is no position where the assumed  
error-detecting code matches the calculated error-  
detecting code; and

means for obtaining the transmission data in the  
15 frame based on the result of the decision.

13. A transmitter for placing variable-length  
transmission data in each frame having a fixed time length  
to transmit the frame, comprising:

20 means for calculating an error-detecting code of the  
transmission data in the frame only if the frame contains  
the transmission data;

means for generating frame data containing the  
transmission data and the calculated error-detecting code  
25 of the transmission data if the frame contains the  
transmission data, and generating frame data that contains  
neither the transmission data nor the error-detecting code

of the transmission data if the frame does not contain the transmission data; and

means for transmitting the generated frame data.

- 5 14. A receiver for receiving, for each frame having a fixed length, frame data containing transmission data and an error-detecting code calculated for the transmission data if the frame contains the transmission data, and receiving, for each frame having the fixed length, frame data  
10 containing neither the transmission data nor the error-detecting code of the transmission data if the frame does not contain the transmission data, the receiver comprising:

means for receiving the frame data;

- 15 means for determining the transmission data and the error-detecting code of the transmission data by determining a predetermined position in the received frame data as the final bit position of the frame data, and calculating an error-detecting code based on the decided  
20 transmission data;

- means for deciding that the frame contains the transmission data if the determined error-detecting code matches the error-detecting code calculated based on the decided transmission data, and deciding that the frame data  
25 does not contain the transmission data or the received frame data contains an error if the determined error-detecting code does not match the calculated error-

detecting code; and

means for obtaining the transmission data in the frame based on the result of the decision.

5 15. A receiver for receiving, for each frame having a fixed length, frame data containing transmission data and an error-detecting code calculated for the transmission data if the frame contains the transmission data, and receiving,  
10 for each frame having the fixed length, frame data containing neither the transmission data nor the error-detecting code of the transmission data if the frame does not contain the transmission data, the receiver comprising:

means for receiving the frame data;

15 means for assuming the transmission data and the error-detecting code of the transmission data by assuming one or more final bit positions of the received frame data, and calculating an error-detecting code based on the assumed transmission data;

20 means for deciding a position to be the final bit position of the frame data if there is the position in the frame where the assumed error-detecting code matches the error-detecting code calculated based on the assumed transmission data among the assumed final bit positions  
25 of the frame data, and deciding that the frame does not contain the transmission data or the received frame data contains an error if there is no position where the assumed

error-detecting code matches the calculated error-detecting code; and

means for obtaining the transmission data in the frame based on the result of the decision.